No. 54 Dec - Jan 1994

solplan review

the independent journal of energy conservation, building science & construction practice

Inside . . .

Environmental concerns are gaining attention. They've moved from the fringe into the mainstream. The excesses of our wasteful immediate past are quickly catching up with us! Fortunately, all is not bleak, as there are many opportunities in resource efficient business and construction practices. We present on overview of some issues behind the concerns, and what the building industry can do.

We present a couple of better building details that should avoid call backs.

Gary Proskiw and Brian Bradley tell us about points to keep in mind when interpreting HOT2000 results. Wonder how dry the airside is on those winter days? We've prepared a table that will give you that information at a glance. (No wonder sparks fly when cross the carpet!)

Other items include new product reviews, letters from readers, TRC news, and much more.

Contents . . .

Re-using Materials

From the Editor . . .

The ways of doing business can be very strange at times. The way you have to haggle may only be an eccentricity. But is it ethical when product liability is sloughed off onto someone else?

If you buy a car, truck or tools, product guarantees and liability will remain with the manufacturer and supplier. It would be inconceivable that it would not be so. You'd be right to get hostile if the truck dealer refused to honour any guarantees but told you to go to the highways department if something went wrong with the truck.

You would not be happy if the distributor of the jigsaw you recently bought told you it is the responsibility of the lumber supplier if something goes wrong with the saw.

Maybe these examples are a bit far fetched, but it's exactly what happens when builders install some ventilation equipment in their houses. I am of course referring to large capacity exhaust fans that are being installed today (down draft kitchen stove-fan units are a special problem).

It has been recognized that if there are combustion appliances in a house, large unbalanced air flows can backdraft combustion appliances leading to unsafe indoor conditions. In fact, the codes now call for make-up air provisions in these situations. This means that the controls may have to be interlocked to ensure that adequate pressure balances are maintained (although doing interlocked wiring will invalidate product safety certifications).

So what are the suppliers of these large exhaust appliances doing? It seems a big fat nothing. They are telling the builder it's his responsibility because he is installing the equipment they have convinced the consumer to specify.

But why should the responsibility and product liability fall on the builder just because he opts to use the equipment? Why is the equipment manufacturer able to walk away from the problems that may be created simply because their product is being used? Surely, it's not too much to ask that such equipment be sold with appropriate make-up air modules?

Builders should insist that the suppliers provide a complete CSA approved stand-alone package, rather than passing off their responsibility. Is it going to take a court case somewhere to get these guys to do the right thing?

Richard Kadulski
Editor

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ISSN: 0828-6574
Date of Issue: January 1994
SOLPLAN REVIEW is published 6 times per year by:
the drawing-room graphic services ltd.
Box 86627, North Vancouver, B.C. V7L 4L2
Tel: 604-689-1841 Fax: 604-689-1841

Street address:
208-1280 Seymour St.
Vancouver, B.C. V6B 3N9

Second Class Mail Registration No. 6855
Postage paid in Vancouver, B.C.
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design & consulting
energy efficient building
consulting services
R-2000 design evaluations
HOT-2000 analysis

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Printed on recycled paper

Global Warming

The Earth's capacity to support life depends on the moderating influences of gases that blanket the planet, warm its surface and protect it from harmful radiation. These gases are referred to as "greenhouse gases." Their warming capacity (the greenhouse effect) is essential to maintaining a climate suitable to all plant, animal, and human life. You've seen or heard many stories about this.

Builders can be a part of the problem or the solution! Understanding the nature of the problem makes it easier to see how we can leave a better world for those that follow us.

Through much of the Earth's history, greenhouse gases have been emitted in amounts that maintained the natural balance needed to regulate the temperature and climate at the planet's surface. In recent years, human activity has started to affect the delicate balance between the Earth's absorption of heat from the sun and its capacity to re-radiate excess heat back into space. Scientists believe that the Earth's climate and, consequently, the future of life on the planet will be irreversibly changed if the emissions of greenhouse gases are not reduced.

The level of greenhouse gas concentrations in the atmosphere significantly affects the amount of heat captured in the greenhouse process. Human activities also affect the Earth's atmospheric chemistry.

What are the Greenhouse gases?

The main Greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide and chlorofluorocarbons.

Carbon Dioxide (CO_2) is one of the most important. It is caused by burning of fossil fuels (natural gas, oil, coal) and wood. For every ton of fuel, at least ¾ ton enters the atmosphere as CO_2. Other sources include people, animals and the result of deforestation.

Since 1860, global emissions of fossil fuel carbon dioxide have increased from 0.1 billion metric tons to approximately 5.9 billion per year in 1988. The United States alone accounted for more than 40% of global emissions in 1950, 22% in 1990. In Canada CO_2 emissions are close to 20 tones a year for every Canadian.

Increasing carbon dioxide concentrations in the atmosphere indicate that the natural carbon cycle may be out of balance.

There are other minor non-combustion sources of carbon dioxide. The most important is the manufacture of cement (through the calcination of limestone).

Forests absorb atmospheric carbon dioxide through photosynthesis and convert it into biomass, primarily wood.

Methane is produced naturally via anaerobic decomposition in biological systems. It is 20 times as powerful a green house gas as CO_2. Natural sources of methane include: wetlands, termites, ocean and fresh water. Methane is a by-product of fossil fuel consumption, rotting of organic waste in landfills, agricultural activities and animal flatulence.

Seventy percent of the emissions of methane released into the atmosphere come from human-related activities (20% of methane emissions on a worldwide basis can be traced to energy use). These include: ruminant animals (such as cows); rice paddies (an artificial wetland); biomass burning; natural gas production and distribution; coal mining; solid waste disposal; and oil and gas drilling.

The major sink for atmospheric methane is the high atmosphere. Unfortunately, increased methane concentrations are also self-perpetuating.

Atmospheric Concentrations of Greenhouse Gases

	Preindustrial Atmospheric Concentration	Current Atmospheric Concentration
Carbon Dioxide	280 ppm	353 ppm
Methane	0.80 ppm	1.72 ppm
Nitrous Oxide	0.29 ppm	0.31 ppm
CFC-11	0	280 ppt
CFC-12	0	484 ppt

Nitrous oxide (N_2O), also known as "laughing gas," is a potent greenhouse gas formed at high temperatures in engines (such as automobiles). When emitted into the atmosphere, nitrogen oxides are very reactive and assist in the formation of urban smog. Concentrations of nitrous oxide are increasing at a rate of 0.3% annually. Nitrogen fertilizer is also a significant contributor of nitrous oxide emissions.

Nitrous oxide is a stable gas with a long atmospheric lifetime. The major atmospheric loss process for nitrous oxide is photochemical decomposition in the stratosphere.

Chlorofluorocarbons and Related Compounds

Chlorofluorocarbons (CFC's) are stable chemicals made of chlorine, fluorine and carbon atoms. They are non-toxic, non-flammable, non-corrosive and very stable. The most important of these compounds are CFC-11 and CFC-12, which until recently were the preferred refrigerants in industrial and consumer applications. These compounds break down only in the presence of solar radiation.

Depletion of the high level ozone layer is caused by CFC molecules in the upper atmosphere. The ozone layer is important, as it filters the ultraviolet radiation that, when it reaches the Earth's surface in excessive amounts, may promote cancer and cataracts in humans and damage a wide variety of flora and fauna.

Ozone

Ozone is an extremely potent greenhouse gas that is both formed and destroyed in the atmosphere. 90% of all ozone is in the stratosphere (high atmosphere). There are no direct emissions of ozone from human sources. Concentrations of ozone are affected, however, by the indirect effects of human activities.

Building with Value: Resource Efficient Construction

As a building professional you get to make choices every day about how resources such as raw materials, people, energy, water, land, air, time and money are used.

Building professionals are challenged to incorporate resource efficient methods, design, and techniques into their daily construction and business practices. With typical American enthusiasm and hustle, the Sustainable Building Collaborative from Portland, Oregon organized an excellent conference and trade show in Seattle Nov. 12-13, 1993. The conference focused on resource efficient construction.

If there were any doubt about the concerns facing the construction industry, the Building with Value conference dispels these thoughts. Over 500 people attended this conference - not the usual mix of bureaucrats and program officials that attend conferences, but people actively involved in the field - mostly builders and designers.

BUILDING WITH VALUE '93
RESOURCE-EFFICIENT CONSTRUCTION CONFERENCE & TRADE SHOW

The conference stressed practical considerations. All speakers were asked to leave the audience with action items they could take home with them. Unlike the usual trade show pitch with standard materials, all products on display involved products and services using recycled or resource efficient materials, processes and services.

For follow up information:
Sustainable Building Collaborative,
815 SE Clatsop, Portland, OR 97202
(503) 235-0137

What is a resource-efficient building?

Resource-efficient construction can be achieved through a step-by-step process that can enhance marketing appeal and reduce waste.

When you build with resources in mind you are aiming for a building that is:

- **Energy efficient**. Does the design keep heat loss to a minimum? Can you upgrade the building envelope? Does it make use of passive solar gains? Are the systems and appliances installed in the building the most energy efficient appliances available? Are there lighting controls, such as timers or sensors, to cut down electricity consumption? It the building built to R-2000 standards or better?
- **Embodied-energy efficient**. This is a relatively new idea. Do the materials used in the building reduce the amount of energy consumed in the manufacture and construction of the building? Look for building components that do the job, but don't require as much energy to make and transport them.

For example, locally produced materials need less fuel to transport to your building site. How much fuel is used to extract the raw material to make product? Start asking your suppliers these questions. That's the first step. More information is becoming available to help you determine if a building component is energy intensive.

Use resource efficient materials (e.g. engineered wood products instead of timbers of wood joists); use recycled products wherever possible. Plant trees (perhaps support tree planting programs to plant an equivalent number of trees used in the construction of your house).

- **A clean-energy user**. How is the energy used to operate the building produced? Does the building itself use renewable energy, such as passive solar, as much as possible? Does the building take advantage of natural ventilation and lighting opportunities? Instead of using a portable generator for power tools on a construction site, can you use a solar cell to generate temporary power?
- **Healthy**. Do the materials used in the building present health risks to workers installing them, or to building users when it's in operation? Where non- or low-toxic alternatives are available and cost-effective, have you used them? Have you taken measures to reduce the harmful effects of building materials, during construction, or in the first weeks of occupation?
- **A wastebuster**. Do materials used in the building reduce the use of raw materials, by being made with recycled content? Do they make use of locally available and often overlooked resources? Do you have a waste management plan for your site? Are there salvaged materials in the building? Is recycling capability designed into the building? Do the water-using appliances and fixtures installed the house conserve water? Does the landscaping reduce outdoor water use? Can you reduce needless concrete work? Can you reduce fuel consumption, by keeping your vehicles tuned up, or can you drive a more energy efficient vehicle? Don't allow the engine to idle needlessly.
- **High quality and affordable**. Is the building's cost per square foot competitive? There's no use making these improvements unless the building owner can pay for them. It's not necessary to pay a premium for common-sense resource-efficient approaches (some resource-efficient practices could reduce the cost of a building). Proper planning combines good construction, resource-efficiency, and improved marketability. When developing land, cluster housing units to create larger green belts.

What resource-efficient construction practices you can take?

Resource-efficient practices and methods can be incorporated into every phase of construction, from design to demolition to disposal. Questions to ask yourself are:

- Does the design, by its nature, reduce waste, save energy, provide economy? For example, does it eliminate under-used or unused space?
- Do you have a waste reduction plan in place?
- Have you taken measures to protect the site during the building project? Measures that protect existing vegetation, and water, air, and soil quality?

How to start?

Each time you make a choice about materials, design, or construction practices, you have the opportunity to "vote" for - or against - resource-efficiency. Your choice may represent a major change in the way you do things, or it may be a small step. Overall, it's still worth it. If resource-efficient concepts are new to you, it's best to start small, working resource-efficient decision-making into your construction projects over time. Check your resources. Read the literature available, talk to your associates, and attend seminars and conferences where the technology is discussed and demonstrated.

Recraft 90: The construction of a resource efficient house

You've seen or heard about many demonstration projects over the years. If technical tests are done, or monitoring is carried out, you may eventually hear about the success or failure of the projects, usually in the proceedings of obscure conferences not too many people attend. Eventually you may benefit from the knowledge gained in such a project, especially is some major manufacturer finds advantage in it, or if it fits into the plans of a utility's program.

Unfortunately, all too often, a lot of knowledge gained in such projects is kept to a select few people that participated in the project. If there were failures and screw-ups, then you rarely hear about those. After all, it's hard to admit you've screwed up. And if the project was sponsored by a company or specific industry, then you're even less likely to hear about the failure.

Thus it's a refreshing change to come across this little booklet by Steve Loken, the builder, describing the construction process used in the **Recraft 90** house in Missoula, Montana. You may have seen articles in the mass media, because this was one of the first demonstration projects that set about to show how much you can do with resource efficient (and recycled) materials.

The no nonsense approach in this brief booklet (56 pages total) manages to describe fully how the house was built, why certain materials selections were made, where compromises had to be made, who sources were, and what the job site experience was.

It's an easy and informative read. I highly recommend this one.

Available for $12.00 from:
Centre for Resourceful Building Technology, P.O. Box 3866, Missoula, MT 59806 Tel 406-549-7678.

Healthy Buildings Resource Guide

This is a directory of products and services for healthier buildings; heating, ventilation & air cleaning; indoor air quality evaluation and guidelines; indoor air quality organizations, and more. It's not just a list of names and addresses, but also contains explanatory notations.

The author, Dan Morris, of Healthy Buildings Associates, has over 30 years of experience in the environmental engineering field. In the heyday of the space era he designed environmental control systems for manned space craft.

While this guide is focused on the Pacific Northwest of the USA, it does have an excellent coverage of sources from other parts of North America.

Price US $19.95
Healthy Buildings Associates,
7190 Fiske Rd. Clinton, WA 98236
Tel 206-221-2962

Energy Source Directories

1994 Residential Energy Source Directory: For those promoting or those practicing energy efficient building construction, this unique volume save time, space and keeps you up-to-date on ever-changing, energy efficient building products. US $ 125.00

1994 Commercial Energy Source Directory: The Commercial Directory focuses on high efficiency HVAC equipment, digital controls, energy efficient motors and the latest in commercial lighting technologies. US $ 175.00.

Iris Communications Inc.
258 East 10th Ave, Suite E
Eugene, OR 97401
Telephone (503) 484-9353
Fax (503) 484-1645

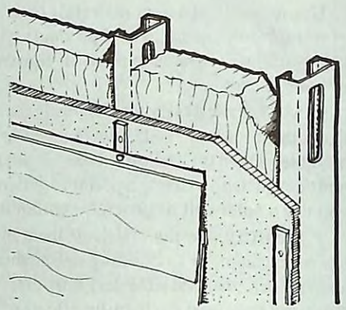
Steel Framing

Every time the price of lumber goes up, we start looking at alternative building materials. Even though wood is still the most flexible material for small structures, there is lots of interest in alternatives, partly due to the recognition that wise resource management is important. The pressures on timber supply mean that prices will stay high - we've just not managed our forest resources efficiently.

A material many builders are looking at steel framing. The framing methods parallel wood construction, but the materials and tools used are different.

We've noted that distributors of steel framing systems are not telling the whole story. As a result there could be serious moisture problems under some situations and severe energy penalties in most situations. Conventional wood framing uses studs, with insulation placed between the studs. While the wood studs have a lower R-value than the insulation (wood has an R-value of about 1.25 per inch thickness) the overall average R-value is still quite respectable.

In the case of steel studs it's the opposite as metal is a thermal bridge - there just is no insulation value to the steel because of the high thermal conductivity of the studs. How much of a thermal bridge was measured at recent tests at the National Research Council of Canada. A 2x4 steel stud wall section, with conventional stucco on the exterior and R-12 batt insulation was measured to have an



overall R-value of 6.8, not the 13.08 that would be calculated using normal assumptions.

The proper way to built steel framing is with rigid insulation sheathing on the exterior. This provides a thermal break to the framing.

The reason metal framing works in commercial buildings is that the acrylic stucco used in commercial buildings is installed on a rigid foam insulation base, which creates a thermal break. Those walls may not have much insulation, but at least there is a break at the stud face.

The moral of the story is, by all means experiment and use steel studs if it is appropriate in your situation, but be sure to review the construction details with care. And always make sure that the framing has a thermal break.

CCMC Registry of Product Evaluations

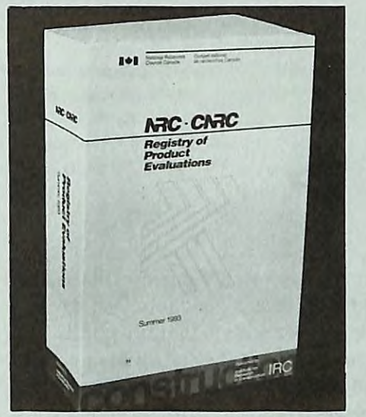
Changes and improvements in construction materials are happening all the time. They don't enter into common practice exclusively through the codes & regulations process.

If a company comes up with an innovative way of turning broken glass into a new kind of roofing, where do they go to see if their idea will be acceptable under the codes?

The Canadian Construction Materials Centre (CCMC) provides a national service for evaluating new and innovative materials, systems and services in all types of construction that cannot be assessed against any existing standard. The results of the evaluations, published by CCMC are a credible source of information for building officials, designers and specification writers, as well as a marketing tool for product manufacturers.

CCMC has earned national support because it has ready access to the latest in construction technology. By tapping the research expertise available at NRC and its network of experts around the world, CCMC is able to develop technology-driven assessment requirements for the most unorthodox of new products. After a product has been tested by a recognized laboratory, the manufacturer-supplied test data are evaluated in relation to those requirements. Products that make the grade are given a unique CCMC evaluation number, which becomes the launching pad for their introduction to the marketplace.

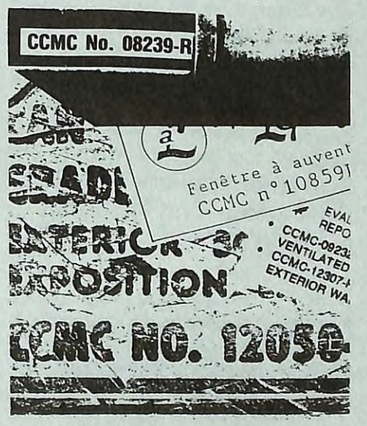
Effective 31 August 1993, CCMC evaluations apply only to products which display the appropriate CCMC number. Unless a CCMC number appears on a product or its packaging, NRC does not guarantee that the product has been evaluated by CCMC. If the nature of the product or system makes an identification of the CCMC number directly on the product impossible, then it should be located



either on the packaging, such as on a bag or container or, in the case of system designs, on the working drawings.

Registry of Product Evaluations is a paperback book to be updated semi-annually conveniently sized for use on the job sites. Individual Evaluation Reports and Listings are easy to find as they are indexed in four ways: by Masterformat division number, by manufacturer's name, by product name, and by report or listing number.

Technical Guides for products for which no standards exist are prepared based upon the latest information. They are generally related to a new products or uses, often designed to demonstrate that the performance is equivalent to that required in a building code such as the National Building Code of Canada.



In addition, the published Reports and Listings imply that the proponent has demonstrated the capability to manufacture a product which meets specified criteria of performance. Evidence of poor performance of a product or failure to conform to evaluation criteria could result in withdraw of the Evaluation Report or Evaluation Listing.

The CCMC evaluations are endorsed by the provinces and territories as a basis for determining the acceptability of new products within the context of building code requirements. In Ontario, CCMC is the only organization designated as a materials evaluation body for the purposes of supporting Rulings on innovative materials, systems and building designs under the Building Code Act.

Exporters of Canadian construction materials also value the NRC linkage. With the help of technical reports from CCMC, they can strengthen their marketing operations and get their products to international customers more quickly.

To receive a free subscription to the Registry of Product Evaluations, contact IRC's Client Services at (613) 993-1231, fax: (613) 952-7673 or write Institute for Research in Construction, National Research Council of Canada, Ottawa, Ontario K1A 0R6

Comparing HOT2000 results to actual, metered data

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UNIES Ltd.

You have been using HOT2000 to determine if house designs meet the R-2000 energy target and have always believed that it does a good job. One day you decide to model your own home and compare the results to the utility bills. You find that the predicted and measured energy usage differs by a significant amount! Does this sound familiar? What's going on? Why the difference?

Does this mean the utility meters are no good (*unlikely*); that you don't know how to perform take-offs (*shudder*); or that HOT2000 is no good (*shriek*)? Don't panic. There are a number of reasons why HOT2000-predicted energy consumption may differ from utility-measured consumption. Most of these are not caused by HOT2000 but in the way the house is interpreted by you, the user, for input to the program.

The same issues are applicable with any energy analysis program. Some utilities have their own in-house programs that are claimed to be more accurate, but what they've done is put in some general 'fudge' factors based on system wide averages to make the results tie in with what they see on their billings.

Before we explore these issues, it is important to distinguish between compliance testing and actual house modelling. When HOT2000 is used for R-2000 compliance testing, standardized default values are required for things like interior temperatures, base loads, weather, etc. to permit a fair comparison between the house and target. When modelling a real house, these default values are no longer appropriate; actual values must be used.

This is a brief description of some of the reasons why actual, measured energy usage data and HOT2000-predicted results can differ.

1. Actual vs. Long-Term Weather

HOT2000 uses 30 year (1951-1980) average weather data which is supplied with the program. It consists of mean monthly values for air temperature, solar radiation, wind speed, etc. When determining compliance with the R-2000 energy target, these are appropriate since the average performance of the house is desired, not that during one specific year. However, if you are comparing actual to modelled performance, then real weather data for the monitoring period must be used.

2. Actual Appliance Loads, DHW Usage and Metabolic (people) Gains

This can be a big one. Indoor appliances, domestic hot water and people all give off significant amounts of heat which reduce the space heating load. Unfortunately, the magnitude of these base loads varies tremendously between houses and is largely determined by lifestyle. They are also difficult to predict.

A house owned by a bachelor, who spends most days at work and most nights roaming the streets looking for trouble, will receive little free gains. Now consider the house next door, which is otherwise identical, but occupied by a family of eight whose hobbies (and supplementary income sources) are bathing baking and ironing. The base loads in the latter dwelling might be five to ten times those of the bachelor's place. To model an actual house, realistic estimates are required for the base loads.

3. Supplemental Heating

If you have supplemental heating such a wood stove, it can make a huge contribution towards the gross heating load and must be accounted for prior to the HOT2000 analysis. One of us recently completed a study in which HOT2000 was used to model a number of houses which had been monitored at the utility meter level. Several of these contained wood heaters of various types. Using homeowner-reported wood usage data, we estimated that about 25% of the total energy load was supplied by the wood heaters.

4. Interior Temperatures

What temperature is your house really kept at? HOT2000 requires two interior air temperatures to be entered: the main floor(s) and the basement (or crawl space). A small error here can have a big effect. For example, we took a typical Winnipeg house file and reduced temperature by 4°C from the R-2000 default values of 21°C and 18°C to account for night setback and the three weeks the owners spend every January getting skin cancer in Jamaica. The effect was 26% reduction in the space heating load.

To simulate an actual house, the temperatures entered into HOT2000 should be "effective" values which include the time-weighed effects of night set-back, weekend and holiday setback, zoning (i.e. keeping different areas of the house at different temperatures) and horizontal and vertical stratification (an important issue for poorly insulated houses). In most cases, the "true" effective temperature is quite different from the thermostat setting.

5. Exterior Shading

HOT2000 assumes that the house is totally unshaded by exterior trees, buildings, mountains, urban sprawl and low-flying aircraft, i.e. it is plopped down in the middle of an infinitely large, flat piece of real estate where every bit of solar radiation which can reach it does reach it. You may say that can't be correct since the program asks the user to input the percentage of south-side obstructions. Want to know a secret? Nothing is done with that number. It is used for documentation purposes only but does not affect the calculations. Prove it to yourself by taking a house file, adjusting the south-side shading and watch the change in the space heating load.

6. Interior Shading of Windows

Interior shading devices such as venetian blinds, drapes, etc. can increase or decrease the heating load depending on their usage. If they are closed during the day, they will reduce the solar gains by reflecting a portion of the incoming solar radiation back outdoors and by absorbing some of the radiation, thus heating the air next to the window thereby increasing the temperature difference across the window and hence increasing the heat loss. If closed at night, shading devices will reduce heat losses. HOT2000 assumes there is no interior shading.

7. Adjacent Structures

This one is a problem for poorly insulated houses, especially those in older neighbourhoods where the houses may only be a few feet apart. HOT2000 assumes that the house is stuck in the ground with no other buildings nearby. However, if a heated dwelling is located beside the house being modelled, below-grade heat losses from your house will be reduced courtesy of the adjacent structure. The neighbour's house will conduct heat to the soil between the two structures which will raise its temperature which will in turn reduce the below-grade losses from the house being modelled.

8. Nominal R-Values

Nominal R-values are used to speed up take-offs by allowing the plans examiner to assume that the effective thermal resistance of a built-up assembly is equal to the R-value of the insulation. The effects of thermal bridging, series and parallel heat flow paths, interior and exterior surface films, etc. are all lumped together by this assumption. For well-insulated assemblies this may not be a perfect solution, but is not bad. The problem occurs with low R-value components such as those in older houses.

Consider an uninsulated above-grade basement wall, 200 mm (8") thick. What is its R-value? The nominal R-value would be zero since there is no insulation. If you enter "0.0" into HOT2000, it will change that value to RSI 0.2 (R-1.1) for calculation purposes and the heat loss through the basement will be huge.

What is the true R-value? The heat flow phenomenon is quite complex involving two or three-dimensional heat flow, thermal storage, the effects of snow against the wall, the presence of cast-in-place framing members, etc. We developed a calculation procedure for analyzing basements which considers some (not all) of these factors and found that typical RSI values (for our example) would range from about 0.6 to 1.0 (R-3.4 to R-5.7). If the "correct" value were (say) RSI 0.6 and you were using RSI 0.2, the predicted heat loss would be 300% of actual.

9. Snow

Snow is an insulator. When it collects beside a basement wall or on an unvented roof, it will reduce heat losses. For a well-insulated cathedral ceiling, the effect is minor but for a poorly or uninsulated basement wall the presence of snow could double the effective thermal resistance. The problem is that the coverage and thickness of snow varies and is difficult to predict, but still has to be considered when modelling real houses.

10. Heating System Efficiency

What is the seasonal efficiency of the heating system (and the DHW system for that matter)? In houses with electric resistance heating, the efficiency can safely be assumed to be 100%. High efficiency gas furnaces operate with efficiencies of 90% to 94% while mid-efficiency units run at about 80% to 82%. With older, low efficiency units, there is a bigger variation in performance. Assuming 60%, when the correct value is (say) 55% will introduce a 9% error in the predicted space heating load.

11. Ventilation System Utilization

The ventilation rate entered into HOT2000 is used to calculate the heat loss due to mechanical air change rate based on 24 hour/day operation. Real-world ventilation rates can be very different. During the Flair Energy Demo project in Winnipeg, we measured how often people used their ventilation systems over a three year period. We found that HRVs were used an average of 19 hours per day, so if you assumed continuous operation, you wouldn't be too far out. Central exhaust systems, however, were operated an average of only 37 minutes/day giving effective rates of less than 2 l/s.

12. Natural Air Infiltration

The airtightness of older houses is much more variable than that of R-2000 construction. The default airtightness levels in HOT2000 provide reasonable averages but the value for your house can be substantially different. Preferably, an airtightness test should be performed on the house if you are attempting to model it.

13. Utility Bills

This one is a little different. Utility meters are usually read every one or two months even though you may be billed every month. Between readings, the utility may estimate your consumption based on historical patterns and the weather during the billing period. If you are comparing HOT2000 against your bills, make sure you are using actual, rather than estimated, meter readings. Also, note the exact dates of the meter readings since they vary by a few days from month to month which may require some correction to your "actual" data. Finally, on rare occasions, meter readings can also be in error, so be careful.

What does it all mean?

1. HOT2000, like all energy analysis programs, is only as accurate as the assumptions used to generate the input data. Bad assumptions mean poor results.

2. To accurately model a real house, you need good estimates for all the inputs normally handled with default values for R-2000 compliance testing. This includes: interior temperatures, base loads, weather, supplemental heating, mechanical ventilation rates, heating system efficiencies, etc. House modelling requires a lot more information, interpretation and skill than compliance testing.

3. It is generally more difficult to accurately model a poorly insulated, leaky house with an old heating system than a well-insulated, tight dwelling with a heating system of known efficiency.

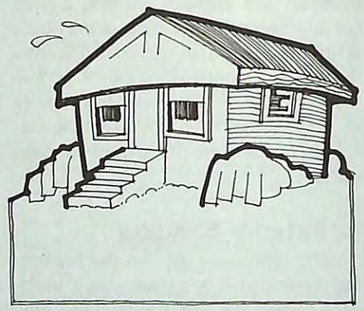
Explaining the House as a System

Are you having a hard time closing a deal for an R-2000 upgrade? Your customer just can't see why they should pay the extra $3,500 for something they can't see- but will spend the money on a hot tub outside, and a marble entry foyer?

The problem may be how to present the "*house as a system*". An interesting way of doing this was noted in a recent copy of B. C. Hydro Power Smart Home Improvements Program notes. They suggest you use "body parts" as terms when explaining the *House As A System*.

All body parts have to be there for it to work - even if some are more expensive. You don't use lots of kidneys just because they are cheap and refuse to use a heart just because it's expensive!

The point to stress is that it's necessary to cut down on energy needs first - then make the supply of energy appropriate.



The point to make when decisions have to be made is: if you can't afford to do it right the first time, then how come you can afford to do it twice?

(It's not far fetched - as you'll pay higher utility bills and for retrofits later on.)

Letters to the Editor

Sir,

I enjoyed the Water Conservation article in your Oct/Nov issue (Solplan Review No. 53). I was recently looking for a 6-litre flush toilet and was disappointed by the low level of knowledge or interest by the wholesalers and manufacturer's sales staff. The best source/supplier of all turned out to be the local Home Hardware store, which retails the Western Potteries Model ARIS 822 for $159.

In my experience it has proved to be a better toilet than the Eljer Ultra 1.5G (no lined tank, poor flush) and the American Standard Ensign (no lined tank). American Standard and Eljer maintain that the tanks don't have to be lined but they're wrong. In Guelph, in the summer and fall, those tanks sweat. The Western Potteries toilet has a lined tank, a gravity flush ballcock mechanism (simple), and an amazing flush. Stand back, children! And its about $75 less than the others (retail)

The major manufacturers and wholesalers had better start listening to what knowledgable people are saying; until then, I'm not specifying their products.

Richard Lay, P. Eng.
Guelph, ON

Sir,

Re: proposed changes to the Residential Ventilation Requirements of the National Building Code for 1995.

I believe that there is cause for concern if the proposed changes are adopted as proposed.

The changes allow the choice of either CSA F326 (Residential Mechanical Ventilation System Standard) or an extensive set of rules (48 pages including the appendix) contained in subsection 9.32.3 as the basis for the provision of a ventilation system. The proposed rules would allow ventilation systems to be installed which are less safe and would not provide the same air distribution performance as a system and installed according to F326 rules.

The proposed rules are extensive and would require that an outside air duct be connected to the return air of forced air systems in houses with forced air systems. If there were no forced air system a supply and exhaust ventilation system with supply ducts to all of the bedrooms and some living areas would be required. An HRV would be required or the outside air would have to be tempered by an in-line heater.

Many of us who have been working with ventilation systems in Canada over the past decade believed that the direction of code regulations in the ventilation area was the adoption of CSA F326 into the building code. The proposed rules for the 1995 NBC is a very recent significant change.

The new rules originated in Ontario where the Ministry of Housing and the Ontario New Home Warranty Program decided that CSA F326 was too difficult for most people to understand. A set of "prescriptive" rules were jointly developed as an alternative.

In the end, Ontario did not adopt these rules but opted for a substantially different (and simpler) set of rules due to the results of several trial installations done in accordance with the proposed rules. The field trials found that there were problems with the proposal to interlock ventilation systems with furnace fans, the temperature of the air coming into return air ducts and the potential depressurization which could occur due to the operation of exhaust devices.

The proposed 9.32.3 rules are "prescriptive", (i.e. they set out what must be done). Part 9 can be used by an owner-builder to build his own house. When built under Part 9 rules, the person doing the building is not required to demonstrate any qualifications or experience "as long as it's done like it says in the code". The building official must accept or reject the construction based on what is specifically required by the code.

Prescriptive rules by definition are not flexible. For them to work every situation must be anticipated and rules describing what to do must be set down. If they were to cover a wide set of systems, they can become quite long and complex. Prescriptive rules are intended for persons who are not knowledgeable on the systems and equipment being used. They are comforting for those unfamiliar with the subject. Nothing is actually "designed", rather a system is selected based on the rules.

Prescriptive rules promote uniformity and make the introduction of new systems and methods more difficult because the "how" is specified in detail and the acceptability of system is judged by how well they conform to the rules, and not how well they provide the intended result.

By their nature, performance rules are flexible and allow a variety of solutions. They are intimidating to those unfamiliar with the subject because they don't tell you exactly how to do it. Performance rules require knowledgeable people who know what systems and equipment are available and how to use them to provide a system to meet the requirements. Performance rules often promote the development of more effective systems and methods because the "how" is not specified in detail, providing the intended result is more important.

CSA F326 is a performance standard. It requires that a certain amount of air be removed from a given location under certain circumstances, and that fans and ductwork used meet certain standards. It does not specify the size of the fan or the size of the duct, rather it relies on the person responsible for providing the system to design and install the system so that the desired results are achieved.

F326 requires that the system provider actually measure the airflow to prove that the system works as intended. On the other hand a prescriptive system would be acceptable even if it did not provide the intend result, as long as it was constructed according to the rules.

There is a need for simple rules by which a person could provide him or herself with a simple functional ventilation system in situations where expert ventilation professionals are not available. Unfortunately, the proposed NBC 9.32.3 rules are much too complex to be workable as "prescriptive" rules. If you are building your own home in Kapuskasing, are trying to put together a decent ventilation system with what you can get at Beaver Lumber, there should be some simple rules you can follow to get a functional ventilation system.

The result of the proposed NBC changes will be a set of ventilation rules which are parallel to CSA F326 and

Sir,

Congratulations! I would like to extend my heartiest congratulations on "earning" not winning the CHBA-BC Maple Leaf Award. I had the honour of receiving the National Award in 1983 and know the commitment you are making to the industry.

You earned it, enjoy it and feel free to be very proud.

J.W. Scott, V.P. Sales & Marketing
All Weather Windows
Edmonton, AB

require lesser safety and performance in several respects. They will not, however, provide their original intent: to make ventilation systems accessible to those without access to skilled ventilation professionals.

The HRAI Ventilation Council has submitted an extensive set of comments on the proposed NBC ventilation rules. The comments ask for significant simplifications of the proposed section 9.32.2 so that they are more accessible to "not-expert" persons installing a ventilation system. The HRAI comments also ask that the "prescriptive" systems comply with the requirements of F326. It is hoped that if changes in this vein are made, they will workable when published. I believe that these changes can be made without changing the intent of the proposed ventilation requirements.

If changes are not made the proposed ventilation rules in section 9.32.3 promise only to add confusion. In 1990 the ventilation requirements in the National Building Code were essentially humorous. The proposed changes for 1995 are more like bad joke.

Dara Bowser
Brantford, ON

Sir:

Re: Fibre Insulation, Solplan Review No. 52 (Aug/Sept, 1993). We wish to commend the author on describing the thermal performance shortcoming that may be experienced during cold weather with low density or poorly fitted glass fibre batts. However, the contention that the problem of too low density of Canadian produced mineral fibre was resolved with the introduction of a minimum resistivity value in the CSA standard, requires qualification.

Although the density/minimum thermal resistivity relationship inferred by the author is probably valid for preformed batt materials, it is not necessarily correct with respect to loose-fill glass fibre. Although the resistivity of low density glass fibre is dependent on its density, the actual installed density may be significantly less than the hypothetical design density used for laboratory testing of resistivity. Consequently, the CSA mandated "minimum resistivity" offers no assurance whatsoever that loose-fill material will be installed at a density adequate to resist formation of convective loop heat loss in an attic during cold weather.

We contend that the consumer would be far better served by a frank discussion of the short comings of the CSA standard for mineral fibre insulation rather than perpetuating the false notion that the standard provides assurance of rated performance. While at it, one might also do the consumer a favour by pointing out that loose-fill cellulose fibre is not subject to this convective looping problem. In fact, recent testing has shown that loose-fill cellulose fibre insulation actually provided increasing values of resistivity as temperature drops.

Criticism aside, the subject article did raise some very meaningful issues concerning performance of commonly used insulations. We look forward to reading more such material in future editions.

Ken Manning, Manager
Research & Development
Can-Cell Industries, Edmonton, AB

Sir,

Re your article about Legionella in water systems (Solplan Review No. 52): this issue was covered in a research paper ("Risk Factors for Contamination of Domestic Hot Water Systems by Legionellae" Applied and Environmental Microbiology, Aug. 1991, p. 2360-2367) that found the problem more common in electric water heaters.

In this study, none of the gas or oil fired water heaters tested contained the bacteria, but 39% of the electric heaters were contaminated. It is believed that the sediment in the bottom of a water heater can be a breeding ground. Many gas and oil heaters are heated from below, meaning that the sediment will be too hot for the Legionella to thrive. Electric heaters have their element several inches off the bottom so the sediment doesn't get as hot, therefore it is a better home for Legionella.

Older water heaters are more likely to be contaminated because they have more sediment. Similarly, older plumbing lines may be corroded enough to have tiny pockets of sediment. Since Legionella needs water that is neither too hot nor too cold, it may be possible to minimise contamination in electric water heaters by simply turning up the temperature. (Electric demand heaters may also minimize risk.) This study found that when the water temperature at the faucet was lower, the water heater was more likely to be contaminated, but it was not a significant difference. It looks like an area where some study is needed.

John Bower
Unionville, IN

Gyp-Crete Infloor Heating Systems has moved from Edmonton to Kelowna, B.C. P.O. Box 24010, Kelowna, V1Y 9P9;
Tel: (604) 769-4472; Fax (604) 769-4587.

The technical services department can be contacted in Calgary at (403) 279-5566.

Equipment Disconnect Order

The B.C. Electrical Safety Branch has issued an order that Aztec-Flexel ceiling heating panels manufactured by Thermaflex Scotland and installed in B.C. after Nov. 3, 1989 must be disconnected. This order applies to units labelled:

Aztec-Flexel CSA LR87166-2 C300.413 (or C500.620) 22 watt per ft².

The product does not have Electrical Safety Branch approval, and has been the cause of several fires.

How Dry Can The Air Get?

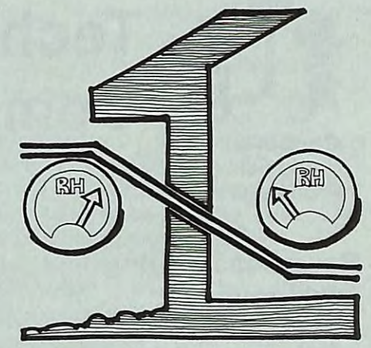
Comfort is described in technical literature as "the absence of discomfort". One of the key elements in the environment that affects our comfort is the humidity in the air.

Relative Humidity (RH) compares the amount of moisture in the air to the maximum amount of moisture the air could hold at that temperature. RH is expressed in percentages. In cold weather, low humidities are a major contributor to the feeling of discomfort inside our homes.

Outdoor-Indoor Relative Humidity Conversion Chart

Exterior RH	-20°F	-10°F	0°F	10°F	20°F	30°F	35°F	40°F	45°F
	-28.8°C	*-23.3°C*	*-17.7°C*	*-12.2°C*	*-6.66°C*	*-1.11°C*	*+1.66°*	*4.44°C*	*7.22°C*
100%	2	4	6	9	17	23	29	36	43
90%	2	3	5	8	15	21	26	31	39
80%	2	3	5	7	13	19	23	27	25
70%	1	2	4	6	11	17	20	24	31
60%	1	2	3	5	9	14	17	21	26
50%	1	1	3	5	8	12	14	18	22

figures in chart are percentages



The way our houses are dried out in the winter is by the exchange of exterior air for stale indoor air. However, when that cold outside air is brought inside and heated, its relative humidity drops as the warm air is capable of holding more moisture.

The table shows what happens when outdoor air is heated to 70°F (21°C). Typical relative humidity of outdoor air in the winter in most parts of Canada will be 75-95%.

Stormwater Catch Basin

Sometimes you see a new product and ask why hasn't someone thought of it before? Maybe thay have, but it hasn't seen the light of day.

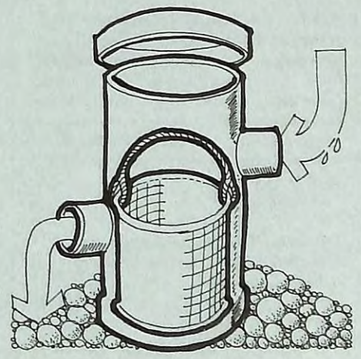
We recently spotted a simple but ingenious storm water catch basin. This is a product that solves a lot of problems for those situations where rain water has to be collected.

The usual way to collect rainwater off the roof, through the downspouts. But we know that gutters collect leaves, branches and all manner of wind blown debris, that gets washed down the drains, so if you are trying to collect the rain water it has to go through some form of filtration to remove the debris.

The Northwest EEE ZZZ Lay Drain Co. (who else, but the Americans can come up with such a name) has developed a catch basin made of out of a standard 8" PVC pipe. As in conventional catch basins, the inlet is higher than the outfall. A rigid removable polyethylene basket acts as a filter screen. The top of the pipe has a fibreglass cap that allows access to pull up the basket for cleaning.

The catch basin sells for $94.95.

For information:
Northwest EEE ZZZ Lay Drain Co.
P.O. Box 654, Gresham, OR 97030
Tel: 503-492-2500
Fax: 503-492-0208



Technical Research Committee News

Canadian Home Builders' Association

Basement wetting problems

Changes in construction and building codes have meant that basements are now being fully insulated. Some builders have noted condensation on the inside face of the poly vapour barrier (on the insulation side of the poly). In some cases, this could be a phenomenon that only happens during the first year after construction in humid climates.

This is a condition that may only apply to some building details and in some climatic conditions. But if the construction can't dry out, there could be long term problems. The TRC would like to know how widespread a problem this may be, and if it requires special study.

If you have encountered any basement wetting problems, contact the TRC. Let them when the extent of the wetting, and when it was noted.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector. Anyone with a problem, technical question of suggestions for areas that need to be investigated is encouraged to contact their local Home Builder's Association technical committee or the TRC directly.
To contact the TRC:

Canadian Home Builders Association,
Suite 200, 150 Laurier Ave. West,
Ottawa, Ont. K1P 5J4

Tel: (613) 230-3060

Water tanks heaters

There is some concern on the part of the hydronics industry about the growing use of domestic hot water tanks as heat sources for space heating. This issue surfaced in B.C. several years ago (Solplan Review No. 45).

The Polaris hot water heater is one unit that has been identified as a problem, although it is not the only unit used this way. The concern seems to be that potable water may be contaminated by legionella bacteria in the standing warm water in the pipes when the water is not being circulated.

Union Gas in Ontario is following up on this issue, to determine what the key issues are.

Anyone who has encountered any types of problems surrounding the use of hot water tanks as heat sources is encouraged to contact the TRC and let us know your experience.

We wonder if this is a ploy by boiler manufacturers to apply boiler standards for low temperature, small systems that are well served by a hot water tank to supply both space and hot water. These types of systems are well matched in terms of size and load to do double duty. Energy efficient boiler systems simply aren't made small enough for today's energy efficient homes. Ed.

CHBA Position Paper on Codes

CHBA is presently putting together a position paper to deal with the issues of codes and regulations, and where they are headed. We've seem many code changes in recent years that seem to go far beyond basic health and safety concerns. Security, energy, and social concerns are creeping into the codes.

Are codes the vehicle to introduce social change? Is there some better way to handle such issues? How much do we let the marketplace guide codes and regulations? Is the marketplace flexible enough to handle such changes?

If you have any thoughts on the directions where codes are going or should be going, contact your local Home Builder's Asssocition and give them your ideas. Now is the time to put your two bits into this important discussion paper, as it will have some impact on the process of regulatory change.

Environmental Products Guide

This new CHBA book, written for the builder, is a comprehensive review of environmental issues. The book does not list specific products and manufacturers, as these are changing so fast, the book would be out of date before printing. However, it explains what the issues are, identifies the nature of the products or processes that are environmentally responsible, and outlines the specifications and properties of suitable materials.

This an excellent primer to environmental product. It will help you know what questions to ask, and what to look for when ordering goods and services.

The book should be ready in time for the CHBA National Convention in Banff in February.

Fire and sound Separations

The National Research Council is undertaking new testing of flanking noise transmission through various construction assemblies. As the density of our urban areas increases, and more dwellings are multiple units, it becomes more important to ensure that sound and fire separations do their job properly. Recent changes in materials standards, new products, and construction detailing has led to a need to review and re-assess existing knowledge on these performance of these elements.

Guidelines for HRV selection

The R-2000 Program uses standard default assumptions when homes are evaluated for compliance with program requirements. This ensures that all comparisons are done on a uniform basis. There has, however, been some ambiguity about which HRV data to use. To clarify these, a new guideline has been released.

If a home being modelled requires a minimum ventilation rate capacity of 45 l/s or less, the HRV rating to be used will be based on an airflow of 30 l/s. If the house being modelled requires a minimum ventilation rate capacity of 46 l/s or more, the HRV rating must be based on an airflow of 55 l/s. This means using data that is closer to the real airflows that will be seen in the house.

You asked us...

The building code requires that foundation walls be backfilled with an exterior drainage layer. How does one do it? What materials are acceptable?

There are few standards that cover these materials, but a good dose of common sense is needed. Soils engineers will often show a detail with 4" (or more) of "free draining" backfill against the wall. This would typically consist of a no fines drain rock - but we've never been able to figure out how to place drain rock vertically against a wall!

Manufactured geo-textile products can be a substitute. They are often used on commercial construction. These involve a sheet material that keeps the soil away from the foundation wall, with some type of semi rigid matrix that keeps the sheet away from the wall, thus creating a gap between the fabric and foundation wall. Any ground water will drain away through the cavity rather than working against the concrete.

Another version of this is the rigid fibreglass board insulation (Baseclad) that provides insulation on the exterior of the foundation. The surface layer of the rigid insulation acts as a drainage layer, draining away ground water. This option has the bonus of providing insulation to the foundation wall.

R-2000 vs standard construction: How much does it cost to heat an R-2000 house, compared to a standard code house?

The answer is not simple, as there are many house designs, many different ways to build them, and many climatic differences. To do a simple comparison, we took a typical house currently being built on the Prairies and in Ontario, and did an analysis using HOT-2000. The characteristics of the typical houses were taken from a housing data base compiled by CMHC. It identifies the house types, sizes, and characteristics of houses in each region of Canada.

We assumed each house was built to the average local standards in Winnipeg, Edmonton, Ottawa, and Toronto. A second run was done for each house, assumed built to current R-2000 standards. The Prairie house has a total heated floor area of 2440 sq.ft., while the typical Ontario house is 3450 sq.ft. (these areas include heated basements).

The results are summarized in the accompanying table. Energy consumption (in kWhr) is noted. We did not do a price calculation as we do not have current fuel costs. Energy prices can change quickly. The significant number is not the dollar amount, but rather the difference in the units of energy consumed. You can apply your local energy prices to the energy units to get a value for your own location.

Energy Consumption (space heating)

	"Ontario" house			"Prairie" house		
CITY	Standard construction	R-2000	Reduction from base case	Standard construction	R-2000	Reduction from base case
TORONTO	22,380 kWhr	15,851 kWhr	29%	15,288 kWhr	11,053 kWhr	28%
OTTAWA	26,479 kWhr	19,139 kWhr	28%	18,416 kWhr	13,265 kWhr	28%
WINNIPEG	36,734 kWhr	25,008 kWhr	32%	23,255 kWhr	16,872 kWhr	28%
EDMONTON	36,580 kWhr	23,005 kWhr	37%	23,283 kWhr	16,663 kWhr	28%

Carpets and Indoor Air Quality

There's a growing awareness among the public regarding environmental issues.

Environmental concerns are not necessarily driven by factors that would drive normal business, but by emotions and fear of regulations. If you don't do it right you're going to get in trouble, with authorities or your clients.

Environmental concerns are a community responsibility and industry's function is to share information with their customers, not to make it an opportunity for a quick profit. Unfortunately, too many turn it into a game of one-upmanship, a shallow marketing gimmick,

The customer's knowledge is defined by sales folders, which refer to brand names, fibre weight, and company information, but not much else.

Stain resistance, soil-hiding properties, low maintenance are features much desired, but they all have a cost associated with them, not just momentary but also environmental in terms of possible emissions.

Last spring a number of stories about the impact of carpets on indoor air quality appeared in the press. Needless to say, the carpet industry is concerned. **Floor Covering Plus,** the industry trade magazine, has carried a number of stories on this subject. They have also pointed some curious inconsistencies that point out the dilemma facing everyone in the building sector.

For example, there was the case of a health care facility. The client expressed concerns related to patient mobility and incontinence. Despite all the technical information they were provided, they made a decision to select a carpet strictly on its appearance value. Even the cap mouldings used were not suited to wheel chairs! The entire market place should be considered as that hospital.

An interesting comment was made by a manufacturer's representative, who pointed out the need for better education of sales people. This is hampered by the fact that they're paid by commission. In that kind of sales environment ethics waver.

The problem of indoor air quality as it applies to carpet, can be solved but it will take more than just carpet manufacturers. The entire floor covering industry will have to make sure they communicate accurate, unbiased information.

Floor Covering Plus commissioned a survey to find out how environmentally concerned residential and commercial consumers are when purchasing carpeting for their homes and businesses. Sales managers, general managers, presidents and owners of 50 leading floor-covering dealers in eight provinces were contacted. Virtually all are familiar with environmentally safe installation adhesives but less than 60% are knowledgeable about carpet pads, and less than 40% know about dyeing chemicals.

What do customers ask about carpets? Most ask about fibre content and where the carpet is made, few ask about environmental studies, dyeing chemicals or carpet disposals (but carpet is a significant factor in the waste going to land fill).

When it comes to knowledge of environmentally safe products in fibres, installation adhesives, adhesive solvents and carpet pads there is much less understanding. With the exception of installation adhesives less than half could name safe products.

Interestingly, there was a feeling that customers would be willing to pay up to 10% more for products proven to be environmentally safe.

Electronic Line Voltage Thermostat

Thermostats are temperature operated switches designed to turn the heating system on or off.

Line voltage thermostats are commonly used with electric heating systems because they are cheap. However, as they have to take the full electric load (compared to the more expensive but more efficient low voltage thermostats), they are built of heavier materials. As a result, the thermostats react to the heat generated within the unit itself so that while these units may be cheap, they are slow to respond to temperature changes. This can result in up to 6°F temperature swings.

A new line voltage electronic thermostat has been developed by Cadet Manufacturing. This unit senses the temperature every 15 seconds, sending a signal to the microprocessor which in turn activates the power relays. The manufacturer claims the unit is capable of maintaining the temperature within 1.5°F of the set point, reducing heating bills by up to 30%.

The C2002 unit has a list price of $49. (Cdn).

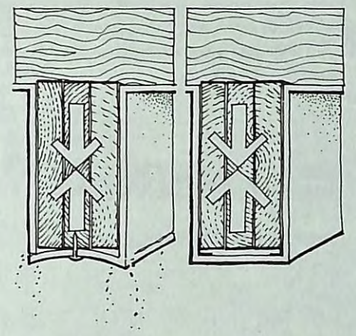
Cadet Manufacturing Co.,
2500 W Fourth Plain Blvd.,
Vancouver, WA 98668
Tel 206-693-2505; Fax 206-694-6939
Canadian Manufacturer's Agent: Gary Reeves Agency,
Tel 604-944-1866;
Fax 604-944-1877

Drywall Solutions:Avoiding cracking problems

Drywall cracks are everyone's headache. The main cause is shrinkage in wood as it dries out. There are many ways to reduce problems, but not all can be followed in all circumstances. Most details incorporate some form of "floating" joint details that allow the wood to shrink without putting stress on the drywall. Joints are the weakest part, which is why most problems happen there.

Glen Fawdry of Fawdry Homes in Kelowna, B.C. has come up with a detail for reducing drywall cracking on built-up beams.

When a beam is finished with drywall, the typical approach is to nail the pieces of drywall to the beam. However, as the wood dries out, the depth of the beam members decreases, but the drywall does not change in size. When you use standard drywall nails or screws, as the wood shrinks, it stresses the joint and it cracks. Glen and his crews realized that the only reason you nail the bottom piece to the beam is to keep it in place, so they developed a floating corner detail. Small finishing nails are used to keep the bottom piece of drywall in place. As the wood shrinks, it pulls the finishing nail up with it, but as there is no nail head, the nail is pulled up through the drywall, so the bottom piece of drywall stays flat, and the drywall is not stressed, thus avoiding cracks.



Professionals: Take Heed!

If you look at the two segments of the retail flooring market, (the professionally installed and the do-it-yourself market), you get very few complaints from the do-it-yourself market. Why? Number one is the do-it-yourselfer typically reads instructions, and isn't looking for shortcuts. Also, the do-it-yourselfer will accept a little less quality in the end job than if they paid to have somebody come in and do it.

Of all the complaints we get (which are not a lot) the DIY part of the business is almost complaint-free.

But it's training, training, training, and that's what's going to keep people coming back to retail stores.

Bob Smith, marketing executive, Armstrong World Industries, quoted on Do-It-Yourself Flooring sales in Floor Covering Plus.

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BUILDING SYSTEM

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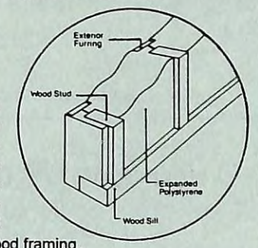
For superior quality wall construction



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FABRICATORS ACROSS CANADA

CCMC evaluation Report No. 09589

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Fax: (709) 579-4660

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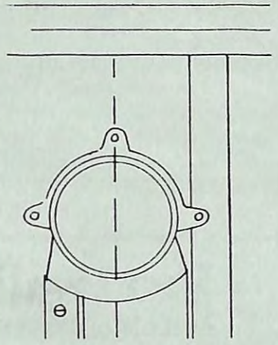

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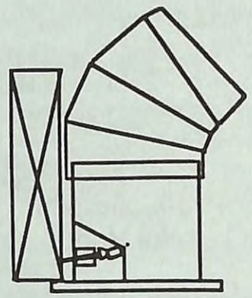

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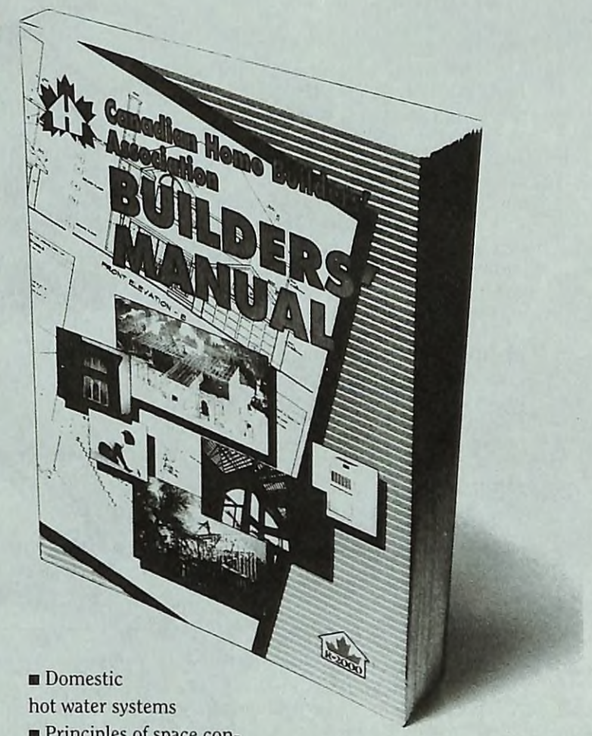

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CONSTRUCTION DEFINITIONS

CONTRACTOR: A gambler who never gets to shuffle, cur or deal.
BID OPENING: A poker game in which the losing hand wins.
ARCHITECT'S ESTIMATE: The cost of construction in heaven.
PROJECT MANAGER: The conductor of an orchestra where every musician is in a different union.
BUILDING CODES: A protective coating made from a half baked mixture of red tape, split hairs, fine print and baloney usually applied at random with a shotgun.
COMPLETION DATE: The point at which liquidating damages begin.
LIQUIDATING DAMAGES: A penalty for failing to achieve the impossible.
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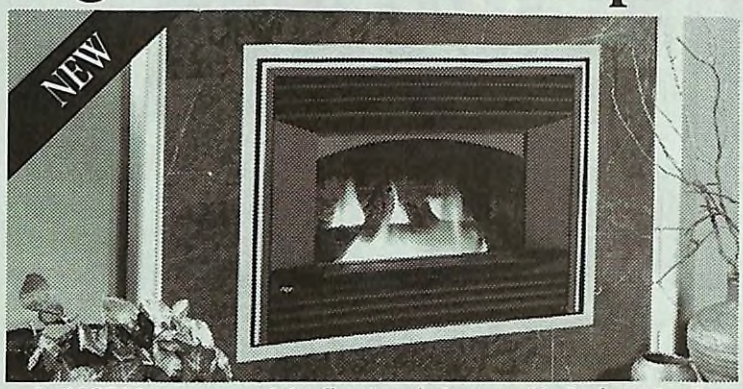

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